CERTIFICATION OF TRANSLATION

I, ***Jeong-min Cho***, an employee of Y.P. LEE, MOCK & PARTNERS of Koryo Bldg., 1575-1 Seocho-dong, Seocho-gu, Seoul, Republic of Korea, hereby declare under penalty of perjury that I understand the Korean language and the English language; that I am fully capable of translating from Korean to English and vice versa; and that, to the best of my knowledge and belief, the statement in the English language in the attached translation of ***Korean Patent Application No. 10-2003-0010410*** consisting of *22* pages, have the same meanings as the statements in the Korean language in the original document, a copy of which I have examined.

Signed this 6th day of August 2010

Jeongmin Cho

ABSTRACT

[Abstract of the Disclosure]

A jelly-roll type battery unit, a winding method thereof and a lithium secondary battery comprising the battery unit are provided. The battery unit includes a first electrode plate having a first electrode current collector with a first electrode tab, and a first electrode active material layer coated on at least one surface of the first electrode current collector, a second electrode plate having a second electrode current collector with a second electrode tab, and a second electrode active material layer coated on at least one surface of the second electrode current collector, and a separator that is interposed between the first electrode plate and the second electrode plate, wherein the electrode tab is incorporated into the electrode current collector in an area of either first or second electrode plate where the corresponding electrode active material layer is not coated. Since an electrode tab is formed by cutting a portion of an electrode current collector and folding upward, deformation of a jelly-roll type battery unit can be prevented.

[Representative Drawing]

FIG. 4

SPECIFICATION

[Title of the Invention]

JELLY-ROLL TYPE BATTERY UNIT AND WINDING METHOD THEREOF AND LITHUM SECONDARY BATTERY COMPRISING THE SAME

[Brief Description of the Drawings]

FIG. 1 is a cross-sectional view showing a winding start portion of a conventional battery;

FIG. 2 is a cross-sectional view showing a winding completion portion of the conventional battery shown in FIG. 1;

FIG. 3 is an extracted perspective view of a lithium secondary battery according to an embodiment of the present invention;

FIG. 4 is a partly extracted perspective view of a portion where an electrode tab of the battery unit shown in FIG. 3 is formed;

FIGS. 5A through 5C show sequential steps of forming the electrode tab shown in FIG. 3, in which FIG. 5A schematically shows a state in which an insulating tape is adhered to an electrode current collector, FIG. 5B schematically shows a state in which the electrode current collector shown in FIG. 5A is partly extracted, and FIG. 5C schematically shows a state in which an electrode tab is formed at the electrode current collector shown in FIG. 5B;

FIG. 6 is a cross-sectional view showing a winding start portion of the battery shown in FIG. 3; and

FIG. 7 is a perspective view showing a battery unit according to another embodiment of the present invention.

< Explanation of Reference numerals designating the Major Elements of the Drawings >

30 : lithium secondary battery
31 : can
32 : battery unit
35 : positive electrode plate
36 : negative electrode plate
37 : separator
41 : positive electrode current collector
41a : positive electrode uncoated area
42 : positive electrode active material layer
43 : positive electrode tab
300 : cap assembly
310 : cap plate
330 : negative electrode terminal
410 : negative electrode current collector

411 : negative electrode uncoated area 420 : negative electrode active material layer

430 : negative electrode tab 491 : first negative electrode insulating tape

492 : second negative electrode insulating tape

[Detailed Description of the Invention]

[Object of the Invention]

[Technical Field of the Invention and Related Art prior to the Invention]

The present invention relates to a lithium secondary battery, and more particularly, to a jelly-roll type battery unit configured such that an electrode tab is incorporated into an electrode current collector and having an improved structure in which electrode plates are disposed, a winding method of the battery unit and a lithium secondary battery employing the battery unit.

Unlike primary battery incapable of charging, secondary batteries are generally capable of charging and discharging. Lithium batteries are in a widespread use in advanced electronic devices such as cellular phones, notebook-type computers, camcorders and the like.

Specifically, the lithium secondary batteries are rapidly developing in view of their high operating voltage of 3.6 V or higher, which is approximately 3 times that of the nickel-cadmium (Ni-Cd) batteries or nickel-hydride (Ni-MH) batteries, and their excellent energy density per unit weight.

Lithium secondary batteries use lithium oxide as a positive electrode active material and a carbon material as a negative electrode active material. The lithium secondary batteries can be classified into liquid electrolyte batteries and solid electrolyte batteries according to the electrolyte used. In general, batteries using a liquid electrolyte are referred to as lithium-ion batteries and batteries using a polymeric electrolyte are referred to as lithium polymer batteries. The lithium secondary batteries can be manufactured in various shapes, typically in cylindrical, rectangular or pouchy shapes.

FIG. 1 shows a winding start portion of a battery 10 disclosed in U.S. Patent No. 5,508,122 and FIG. 2 shows a winding completion portion of the battery 10 shown in FIG. 1.

Referring to the drawings, the battery 10 includes a positive electrode plate 1, a negative electrode plate 2 and a separator 3. The positive electrode plate 1 includes a positive electrode current collector 11 and positive electrode slurry coated on both surfaces of the positive electrode current collector 11. A positive electrode tab 12 is attached to a portion of the positive electrode plate 1 where the positive

electrode slurry is not coated. The positive electrode current collector 11 and the positive electrode tab 12 are both made of aluminum.

The negative electrode plate 2 includes a negative electrode current collector 21 and negative electrode slurry coated on both surfaces of the negative electrode current collector 21. A negative electrode tab 22 is attached to a portion of the negative electrode plate 2 where the negative electrode slurry is not coated. The negative electrode current collector 21 is made of a copper foil and the negative electrode tab 22 is made of nickel.

In the battery 10 having the above-described configuration, the separator 3, the positive electrode plate 1 and the negative electrode plate 2 are wound around a windng spool 4 in that order. The negative electrode plate 2 is wound onto the electrode unit greater than or equal to 15 mm after the beginning of the positive electrode plate 1. Thus, the surface of the positive electrode tab 12 faces the positive electrode current collector 11 with the separator 3 disposed therebetween.

As to the winding completion portion of the battery 10, the surface of the negative electrode tab 22 faces the separator 3, an insulating tape 5 is attached to the end portion of the positive electrode slurry and winding of the negative electrode tab 22 is then performed. Thus, vortex of electrodes can be prevented and the positive electrode plate 1 may not be positioned at a portion facing the negative electrode tab 22.

However, the conventional battery 10 has the following problems.

The negative electrode tab 22 made of a nickel plate is attached to an area of the negative electrode plate 2 made of a copper foil where negative electrode slurry is not coated uncoated, by ultrasonic welding. Here, since the negative electrode plate 2 has the negative electrode tab 22 made of a different metal from the same, it is prone to deformation during charge and discharge.

In particular, in the case of using a strip-shaped electrode plate, adhesiveness between each electrode plate and a separator may be lowered due to foreign matter during winding, producing a non-charged area and deforming a jelly-roll type battery unit, thereby affecting the thickness of the battery 10.

Since the negative electrode tab 22, which is separately provided, is welded on the negative electrode plate 2, the material cost increases due to consumption of the negative electrode tab 22. Also, use of different metals increases internal resistance.

[Technical Goal of the Invention]

The present invention provides a jelly-roll type battery unit having the improved structure to prevent the battery unit from being deformed by using a partly

cut portion of a current collector as an electrode tab, a winding method of the battery unit and a lithium secondary battery comprising the battery unit.

The present invention also provides a jelly-roll type battery unit having the improved efficiency, the battery unit being wound in a state in which an electrode tab partially overlaps a current collector of the opposite polarity, a winding method of the battery unit and a lithium secondary battery comprising the battery unit.

[Structure and Operation of the Invention]

According to an aspect of the present invention, there is provided a jelly-roll type battery unit including: a first electrode plate having a first electrode current collector with a first electrode tab, and a first electrode active material layer coated on at least one surface of the first electrode current collector; a second electrode plate having a second electrode current collector with a second electrode tab, and a second electrode active material layer coated on at least one surface of the second electrode current collector; and a separator that is interposed between the first electrode plate and the second electrode plate, wherein the electrode tab is incorporated into the electrode current collector in an area of either first or second electrode plate where the corresponding electrode active material layer is not coated.

The electrode tab may be formed by cutting a portion of a winding start portion of the electrode current collector and folding upward.

The electrode tab may be cut at least a half widthwise with respect to the electrode current collector so as to be exposed toward the upper end of the electrode current collector.

An insulating tape may be adhered to either surface of the electrode tab.

According to another aspect of the present invention, there is provided a method of winding a jelly-roll type battery unit including: forming a first electrode plate such that a first electrode tab formed at a first electrode current collector is integrally connected to the first electrode current collector at a winding start portion of the first electrode current collector; forming a second electrode plate having a second electrode current collector with a second electrode tab attached thereto; preparing a separator interposed between the first and second electrode plates; and winding the first and second electrode plates together with the separator interposed therebetween.

In step of forming the first electrode plate, the first electrode tab may be formed by cutting a portion of the first electrode current collector and folding upward.

An end of the first electrode tab may be cut at least a half widthwise with respect to the first electrode current collector so as to be exposed toward the upper end of the first electrode current collector.

According to another aspect of the present invention, there is provided a lithium secondary battery, which is manufactured by the method of winding the jelly-roll type battery unit, including: a battery unit having a first electrode plate having a first electrode tab, a separator and a second electrode plate of the opposite polarity to the first electrode plate, the second electrode plate having a second electrode tab, sequentially disposed; a can having a space in which the battery unit is housed; and a cap assembly connected to an upper portion of the can, and having a cap plate and an electrode terminal connected to the cap plate through a terminal throughhole formed in the cap plate and having a gasket at its outer surface for insulation from the cap plate, wherein the first electrode plate includes a first electrode current collector formed by cutting the first electrode tab and folding upward, and a first electrode active material coated on at least one plane of the first electrode current collector, and the second electrode plate includes a second electrode current collector with a second electrode tab attached thereto, and a second electrode active material coated on at least one plane of the second electrode current collector.

A jelly-roll type lithium secondary battery according to the present invention will now be described in detail with reference to the accompanying drawings.

FIG. 3 shows a rectangular lithium secondary battery 30 according to an embodiment of the present invention.

Referring to FIG. 3, the lithium secondary battery 30 includes a can 31, a battery unit 32 housed inside the can 31 and a cap assembly 300 connected to an upper portion of the can 31.

The can 31 is made of a rectangular metal having a cavity. The can 31 itself serves as an electrode terminal. The can 31 is preferably made of aluminum.

A safety vent 33 is formed on the bottom surface 31a of the can 31. Since the safety vent 33 is thinner than other portions of the can 31, when internal pressure of the can 31 increases due to overcharge, the thinner portion is broken faster than the other portions of the can 31, thereby improving safety of the battery.

In order to prevent a charge-discharge probe from being damaged when the probe contacts the bottom surface 31a during a formation process, a protective plate 34 made of nickel is fixedly welded to a lower portion of the safety vent 33.

The battery unit 32 housed inside the can 31 includes a positive electrode plate 35, a negative electrode plate 36 and a separator 37. The positive and negative electrode plates 35 and 36 and the separator 37are formed of a sheet of strip, respectively. The battery unit 32 has the positive electrode plate 35, the separator 37 and the negative electrode plate 36 and the separator 37 sequentially disposed and wound.

The cap plate 310 is provided at the cap assembly 300 connected to an

upper portion of the can 31. The cap plate 310 is a metal plate having the size and shape corresponding to an opening of the can 31. A terminal throughhole 311 having a predetermined size is formed at the center of the cap plate 310.

An electrode terminal, e.g., a negative electrode terminal 330, is positioned at the terminal throughhole 311 so as to be inserted into the terminal throughhole 311. A tube-shaped gasket 320 is installed at the outer surface of the negative electrode terminal 330 for insulation from the cap plate 310. An insulating plate 340 is installed on the bottom surface of the cap plate 310. A terminal plate 350 is installed on the bottom surface of the insulating plate 340. The lower end of the negative electrode terminal 330 is electrically connected to the terminal plate 350.

An electrolytic solution inlet 312 is formed at one side of the cap plate 310. The electrolytic solution inlet 312 has a ball 370 sealably connected thereto.

An insulation case 360 is installed between the battery unit 31 and the cap assembly 300 for electrical insulation therebetween. The insulation case 360 is made of a polymer resin having an insulating property, preferably polypropylene.

One feature of the present invention is that an electrode tab electrically connected to an electrode plate of the battery unit 31 is formed by cutting a portion of the electrode plate to then be incorporated thereinto.

In addition, this will now be described in more detail.

FIG. 4 shows the battery unit 32 shown in FIG. 3.

Referring to FIG. 4, the battery unit 32 includes a strip-shaped positive electrode plate 35, a negative electrode plate 36, and a separator 37 interposed between the positive and negative electrode plates 35 and 36.

The positive electrode plate 35 includes a positive electrode current collector 41 made of an aluminum foil, and a positive electrode active material layer 42 having lithium-based oxide coated on both surfaces of the positive electrode current collector 41. The positive electrode current collector 41 includes a positive electrode uncoated area 41a where the positive electrode active material layer 42 is not formed. A positive electrode tab 43 is welded to the positive electrode uncoated area 41a. An end of the positive electrode tab 43 protrude toward the upper end of the positive electrode current collector 41.

In order to insulate the positive electrode 35 from the negative electrode 36 or to prevent the separator 37 from being torn by the positive electrode tab from 43, a plurality of positive electrode insulating tapes 481 and 482 are attached to the outer surface of the positive electrode uncoated area 41a of the positive electrode tab 43. The positive electrode insulating tapes 481 and 482 preferably cover a boundary between the upper end of the positive electrode current collector 41 and the positive electrode tab 43.

The negative electrode plate 36 includes a negative electrode current collector 410 made of a copper foil, and a negative electrode active material layer 420 having carbon material coated on both surfaces of the negative electrode current collector 410. The negative electrode current collector 410 includes a negative electrode uncoated area 411 where the negative electrode active material layer 420 is not formed. A negative electrode tab 430 is welded to the negative electrode uncoated area 411. An end of the negative electrode tab 430 protrude toward the upper end of the negative electrode current collector 410.

Like in the positive electrode plate 35, a plurality of negative electrode insulating tapes 491 and 492 are attached to the outer surface of the negative electrode uncoated area 411 of the negative electrode tab 430. The negative electrode insulating tapes 491 and 492 preferably cover an interface between the upper end of the negative electrode current collector 410 and the negative electrode tab 430.

Unlike in the positive electrode plate 35, the negative electrode tab 430 is formed by cutting a portion of the negative electrode current collector 410. In other words, the negative electrode tab 430 can be formed by cutting a winding portion of the negative electrode uncoated area 411 by at least half the width of the electrode tab and folding the cut winding portion to the upper end of the negative electrode current collector 410 that is not cut. A portion of the folded portion of the negative electrode uncoated area 411 should be exposed a predetermined length to the upper portion of the negative electrode current collector 410 so that it is electrically connected to a negative electrode terminal.

When the negative electrode uncoated area 411 is folded, the negative electrode insulating tapes 491 and 492 surrounding the outer surface of the negative electrode current collector 410 are also folded, which is advantageous in view of manufacturing process, thereby preventing short-circuit between the positive electrode 36 and the negative electrode plate 36 or preventing the separator 37 from being torn.

Accordingly, the negative electrode tab 430 is incorporated into the negative electrode current collector 410. As described above, the negative electrode tab 430 is constructed such that the negative electrode uncoated area 411 that is wound for the first time in winding process is cut and folded upward to then be connected to the negative electrode terminal.

The separator 37 is disposed between the positive electrode plate 35 and the negative electrode plate 36 for insulation. The separator 37 is made of polyethylene, polypropylene or a composite film of polyethylene and polypropylene. In order to prevent short-circuit between the electrode plates 35 and 36, the

separator 37 is advantageously wider than the positive or negative electrode plate 35 or 36.

The electrode plate having an electrode tab incorporated thereinto is manufactured as follows.

FIG. 5A schematically shows a state in which the insulating tapes 491 and 492 are adhered to the negative electrode current collector 410 shown in FIG. 4, FIG. 5B schematically shows a state in which the electrode current collector 410 shown in FIG. 5A is partly extracted, and FIG. 4C schematically shows a state in which the negative electrode tab 430 is formed at the negative electrode current collector 410 shown in FIG. 5B.

Referring to FIG. 5A, the negative electrode current collector 410 is formed in a strip shape and the negative electrode active material layer 420 is formed on the surface of the negative electrode current collector 410. The negative electrode uncoated area 411 where the negative electrode active material layer 420 is not coated is formed on the negative electrode current collector 410. The negative electrode uncoated area 411 corresponds to a winding start portion in winding.

The negative electrode insulating tapes 491 and 492 having a predetermined width are adhered to a leading edge of the negative electrode uncoated area 411. The negative electrode insulating tapes 491 and 492 are advantageously adhered to the front and rear surfaces of the negative electrode current collector 410 for insulation from the other electrode. The upper ends of the negative electrode insulating tapes 491 and 492 cover the upper portion of the negative electrode uncoated area 411. The negative electrode insulating tapes 491 and 492 may also be adhered after the negative electrode tab 430 is formed.

As shown in FIG. 6B, the leading edge of the negative electrode uncoated area 411 having the negative electrode insulating tapes 491 and 492 is cut by a predetermined width as indicated by a dotted line. A cut portion 431 of the negative electrode uncoated area 411 has a size corresponding to the width of the negative electrode tab 430 to be formed in a subsequent process. The cut portion 431 is cut at least a half widthwise with respect to the negative electrode current collector 410 from the lower end of the negative electrode uncoated area 4110. This is to expose the end of the cut portion 431 to the upper end of the negative electrode uncoated area 411 when the cut portion 431 is folded upward.

As shown in FIG. 6C, the cut portion 431 is folded toward the upper end of the negative electrode current collector 410, forming the negative electrode tab 430. One end 432 of the negative electrode tab 430 is exposed outside the upper end of the negative electrode current collector 410 to then be connected to the negative electrode terminal when the battery is assembled.

As described above, the negative electrode tab 430 forms the negative electrode terminal by cutting a portion of the negative electrode uncoated area 411 and folding the same. Thus, the negative electrode tab 430 is integrally formed with the negative electrode current collector 410. In other words, a separate electrode tab is not necessarily welded to the negative electrode current collector 410.

The negative electrode insulating tapes 491 and 492 coated on both surfaces of the negative electrode uncoated area 411 having the negative electrode tab 430 are also folded upward when folding the negative electrode tab 430.

Accordingly, the negative electrode insulating tape 491 is disposed on the inner surface of the negative electrode tab 430 and the negative electrode insulating tapes 492 is disposed on the outer surface of the negative electrode tab 430.

The battery unit having the electrode plate having an electrode tab incorporated thereinto is wound as follows.

FIG. 6 shows a winding start portion of the battery unit 32.

Here, the same reference numerals as those described above denote the same functional elements.

Referring to FIG. 7, the battery unit 32 includes a negative electrode plate 36, a separator 37, a negative electrode plate 35 and a separator 37 sequentially disposed from the innermost part thereof, and the resultant structure is wound in on direction in such a disposed state.

In the winding start portion of the negative electrode plate 36, the negative electrode tab 430 is integrally formed with the negative electrode current collector 410 on the negative electrode uncoated area 411. The negative electrode tab 430 is formed by cutting a portion of the negative electrode uncoated area 411 and folding the same. A negative electrode insulating tape 490 is attached to either surface of the negative electrode uncoated area 411 having the negative electrode tab 430.

At a portion where the negative electrode tab 430 is formed, the negative electrode uncoated area 411 is folded and the negative electrode insulating tape 490 is interposed between the inner and outer surfaces of the portion where the negative electrode tab 430 is formed. Accordingly, the portion where the negative electrode tab 430 is formed has a multi-layered structure. A negative electrode active material layer 420 is coated on the negative electrode current collector 410 spaced apart from the portion where the negative electrode tab 430 is formed.

The separator 37 is disposed on the outer surface of the negative electrode plate 36.

A positive electrode current collector 41 having a positive electrode active material layer 42 coated on its both surfaces is disposed on the outer surface of the

separator 37. A separate positive electrode tab 43 is welded to a positive electrode uncoated area 41 of the positive electrode current collector 41. A positive electrode insulating tape 480 is attached to the outer surface of the positive electrode current collector 41 having the positive electrode tab 43.

Another separator 37 is disposed on the outer surface of the positive electrode plate 35.

The battery unit 32 having the above-described configuration is wound in one direction and is made to have a size so as to be housed inside a rectangular can (31 shown in FIG. 3). The negative electrode tab 430 is wound such that the positive electrode current collector 41 partially overlaps at the center of the battery unit 31. Since two opposite electrode tabs 43 and 430 are disposed at the center of the battery unit 31 in such a manner, current collection can be more effectively achieved.

FIG. 7 shows a battery unit 720 according to another embodiment of the present invention.

Referring to FIG. 7, the battery unit 720 is configured such that a positive electrode plate 750 and a negative electrode plate 760 are disposed with a separator 770 interposed therebetween and wound in a jelly-roll configuration.

As described above, the positive electrode plate 750 includes a positive electrode current collector and a positive electrode active material layer coated on at least one plane of the positive electrode current collector, and the negative electrode plate 760 includes a negative electrode current collector and a negative electrode active material layer coated on at least one plane of the negative electrode current collector. Also, the positive electrode tab 730 and the negative electrode tab 740 are electrically connected to an uncoated area of either the positive or negative electrode current collector. A sealing tape 790 is wrapped around edge portions of the positive or negative electrode tabs 730 and 740.

The positive electrode tab 730 is formed by cutting a portion 752 of the positive electrode current collector. In other words, the positive electrode tab 730 can be formed by cutting a portion of a winding completion portion 751 of the positive electrode plate 750 by a width of the electrode tab and folding toward an upper end of the positive electrode plate 750 that is not cut.

In order to make the battery unit 720 maintain its shape after being wound in a jelly-roll configuration, which is quite a difficult work due to its elasticity, an insulative finishing tape 780 is installed on the outer surface of the outermost positive electrode plate 750. The finishing tape 780 has an insulating property like the electrode insulating tape and is capable of maintaining the shape of the battery unit 720.

[Effect of the Invention]

As described above, the jelly-roll type battery unit according to the present invention, the winding method thereof and the lithium secondary battery manufactured using the same have the following advantages.

First, since an electrode tab is formed by cutting a portion of an electrode current collector and folding upward, deformation of a jelly-roll type battery unit can be prevented.

Second, since a cut portion of an electrode current collector is used in forming an electrode tab, rather than separately providing the electrode tab, a material cost can be saved.

Third, an increase in internal resistance due to use of an electrode tab made of different metals can be prevented.

Fourth, since a plurality of insulating tapes are attached to both surfaces of an electrode current collector having an electrode tab incorporated theretinto, electrical short-circuit between electrode plates of opposite polarities can be avoided during assembling of a battery.

Fifth, since a plurality of insulating tapes are attached to both surfaces of an electrode tab formed by cutting an electrode current collector and folding up, electrical short-circuit due to burring of the electrode tab can be prevented.

Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. A jelly-roll type battery unit comprising:

a first electrode plate having a first electrode current collector with a first electrode tab, and a first electrode active material layer coated on at least one surface of the first electrode current collector;

a second electrode plate having a second electrode current collector with a second electrode tab, and a second electrode active material layer coated on at least one surface of the second electrode current collector; and

a separator that is interposed between the first electrode plate and the second electrode plate, wherein the electrode tab is incorporated into the electrode current collector in an area of either first or second electrode plate where the corresponding electrode active material layer is not coated.

2. The jelly-roll type battery unit of claim 1, wherein the electrode tab is formed by cutting a portion of a winding start portion of the electrode current collector and folding upward.

3. The jelly-roll type battery unit of claim 2, wherein the electrode tab is cut at least a half widthwise with respect to the electrode current collector so as to be exposed toward the upper end of the electrode current collector.

4. The jelly-roll type battery unit of claim 2, wherein an insulating tape is adhered to either surface of the electrode tab.

5. The jelly-roll type battery unit of claim 4, wherein the insulating tape is interposed between the inner and outer surfaces of the electrode tab that is folded upward.

7. A method of winding a jelly-roll type battery unit comprising:

forming a first electrode plate such that a first electrode tab formed at a first electrode current collector is integrally connected to the first electrode current collector at a winding start portion of the first electrode current collector;

forming a second electrode plate having a second electrode current collector with a second electrode tab attached thereto;

preparing a separator interposed between the first and second electrode plates; and

winding the first and second electrode plates together with the separator

interposed therebetween.

8. The method of claim 7, wherein in step of forming the first electrode plate, the first electrode tab is formed by cutting a portion of the first electrode current collector and folding upward.

9. The method of claim 8, wherein an end of the first electrode tab is cut at least a half widthwise with respect to the first electrode current collector so as to be exposed toward the upper end of the first electrode current collector.

10. The method of claim 9, wherein the first electrode tab is cut widthwise with respect to the first electrode current collector.

11. The method of claim 7, wherein the first electrode tab is wound on a vertical axis that is substantially the same as the surface to which the second electrode tab is attached.

13. The method of claim 7, wherein an insulating tape is adhered to either surface of the first electrode current collector having the first electrode tab.

14. A lithium secondary battery comprising:

a battery unit having a first electrode plate having a first electrode tab, a separator and a second electrode plate of the opposite polarity to the first electrode plate, the second electrode plate having a second electrode tab, sequentially disposed;

a can having a space in which the battery unit is housed; and

a cap assembly connected to an upper portion of the can, and having a cap plate and an electrode terminal connected to the cap plate through a terminal throughhole formed in the cap plate and having a gasket at its outer surface for insulation from the cap plate,

wherein the first electrode plate includes a first electrode current collector formed by cutting the first electrode tab and folding upward, and a first electrode active material coated on at least one plane of the first electrode current collector, and the second electrode plate includes a second electrode current collector with a second electrode tab attached thereto, and a second electrode active material coated on at least one plane of the second electrode current collector.

15. The lithium secondary battery of claim 14, wherein an end of the first

electrode tab is cut at least a half widthwise with respect to the first electrode current collector from an area where an electrode active material layer is not coated so as to be exposed toward the upper end of the first electrode current collector.

16. The jelly-roll type battery unit of claim 1, wherein the electrode tab is formed by cutting a portion of a winding start portion of the electrode current collector and folding upward.

FIG. 1

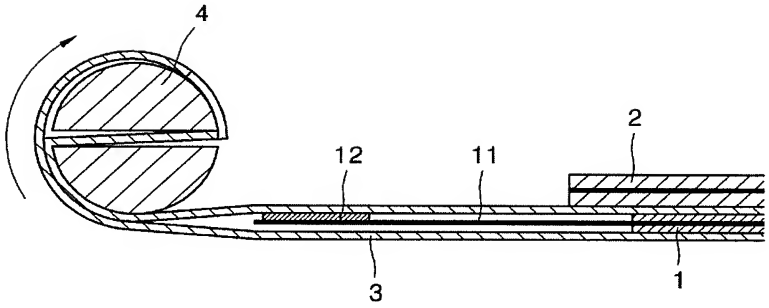


FIG. 2

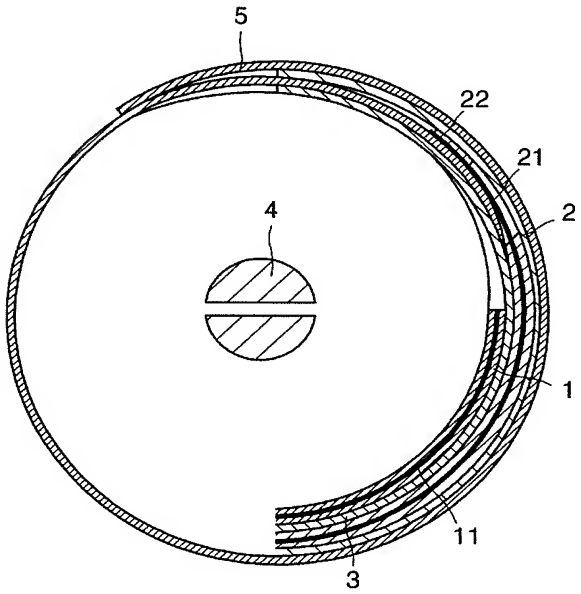
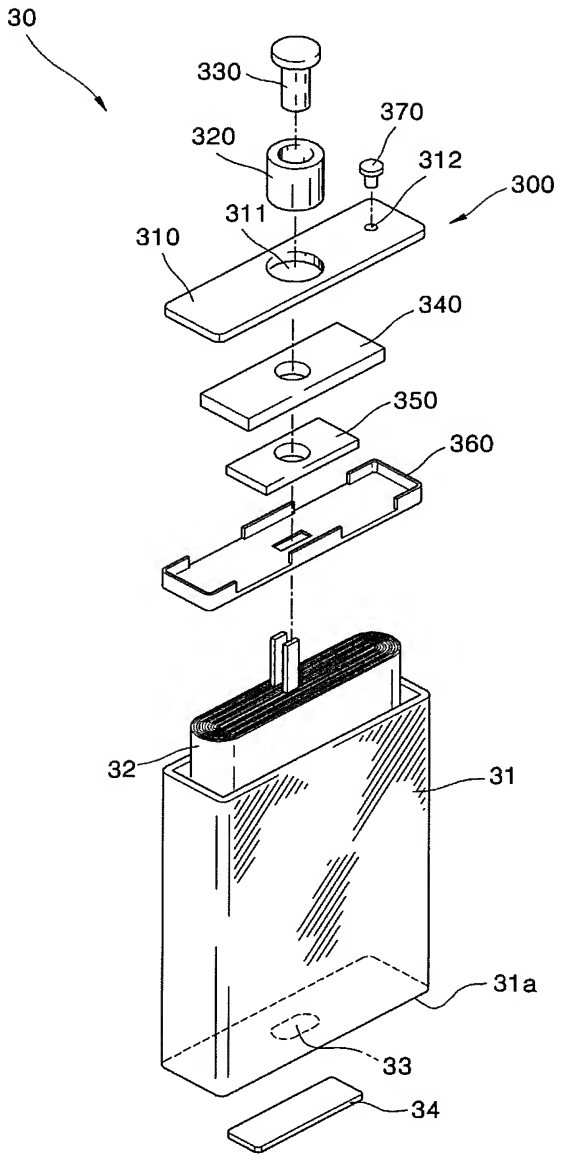


FIG. 3



32

FIG. 4

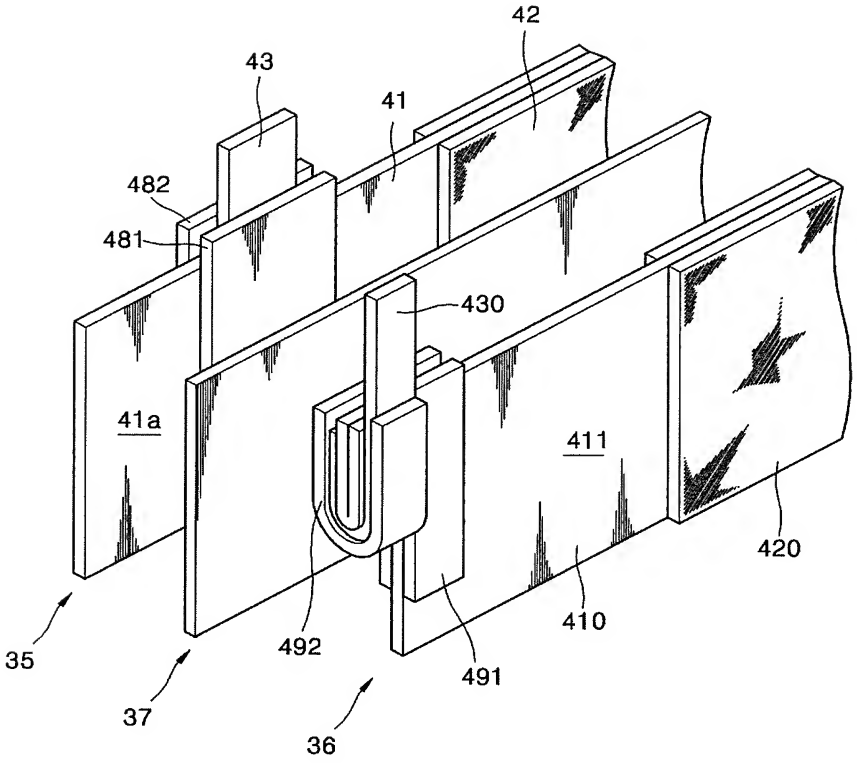


FIG. 5 A

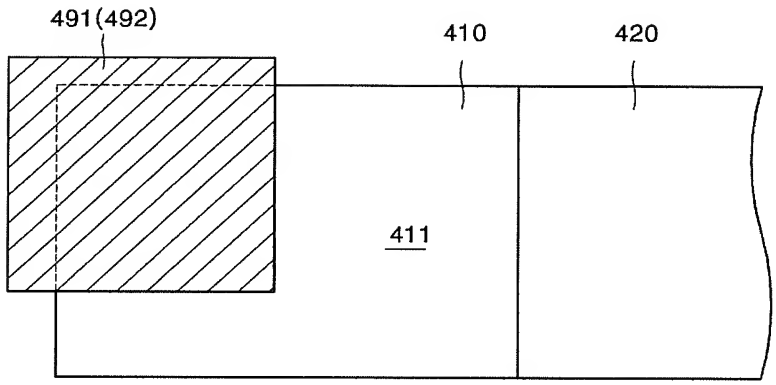


FIG. 5 B

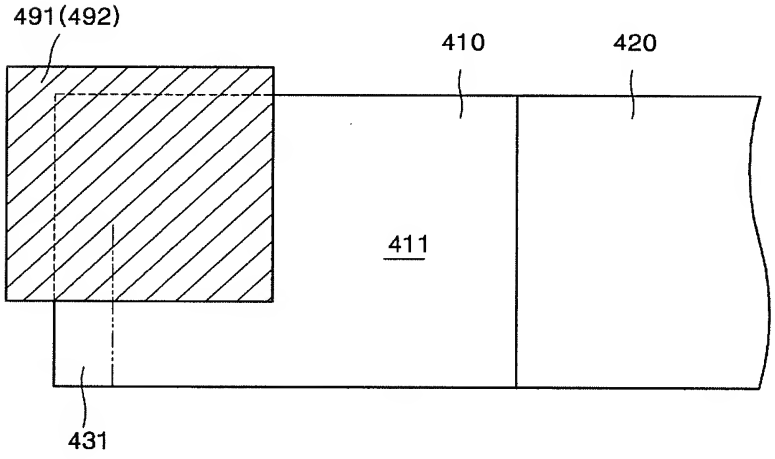


FIG. 5 C

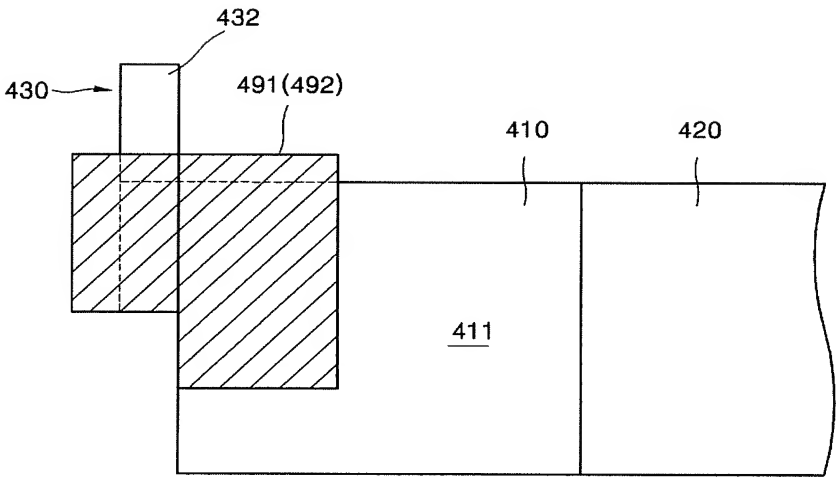


FIG. 6

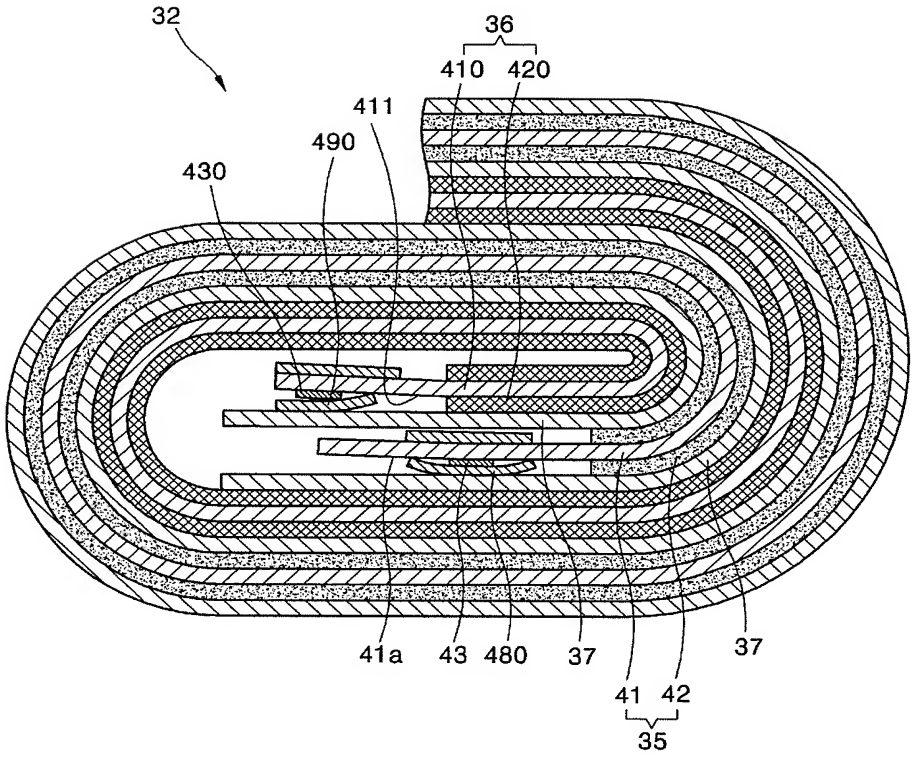


FIG. 7